

l'Inst. Pasteur, Nov. 1902); it was therefore of interest to experiment on its efficacy against *Tr. gambiense*.

It results from experiments which I have made on rats that arsenious acid, given in sufficient doses, causes the *Tr. gambiense* to disappear from the greater circulation, at least in a temporary manner, and that it can hasten the cure of Trypanosomiasis in these animals. The efficacious dose is 0.1 mgr. of arsenious acid for every 20 grm. of animal, *i. e.* 1 mgr. for a rat of 200 grm.; below this dose the results are nil or incomplete.

(*Note*.—This is also the efficacious dose in Nagana, Surra, and Caderas. The solution employed for hypodermic injection has the following composition:—Arsenious acid 1 grm., carbonate of soda 1 grm., distilled water 500 grm.—Laveran and Mesnil, *op. cit.*)

In human Trypanosomiasis arsenical compounds have been often tried and have yielded only a passing amelioration, but in general the doses prescribed have been too feeble. Judging by the results of experiments on animals, one may say that the method which consists in giving small daily doses of arsenious acid (the method most frequently adopted in the treatment of human Trypanosomiasis) is bad, and that it is preferable to administer large doses at longer intervals.

Writers are all agreed that human Trypanosomiasis is always fatal as soon as the nervous symptoms declare themselves, but before the appearance of these symptoms there is a period, more or less long, during which the Trypanosomes, in small number in the blood, produce but few morbid troubles. In this first phase it is probable that the infection produced by *Tr. gambiense* is curable in the human subject as it is in many species of animals, and that arsenious acid may contribute to a cure.

Good hygienic conditions and abundant food are also important factors in the treatment of Trypanosomiasis; in Africa the "sleeping sickness" rages with a peculiar intensity among the miserable Negro labourers, overworked and ill-fed. (*Note*—Christy, Rep. of the Sleeping Sickness Comm., Nov. 1903: in Uganda the epidemic of Trypanosomiasis has been greatly aggravated by famine.) The same thing is observed among animals, those that have some defect or some cause of enfeeblement are more strongly infected than those which are in good condition and are supplied with abundant food.—*Comptes Rendus*, tome cxxxviii. p. 450 (22 Feb., 1904).

Relations between the Development of the Tracheal Apparatus and the Metamorphoses of Insects. By JULES ANGLAS.

The phenomena of internal metamorphosis have in Insects a strict relation to the development of the respiratory apparatus.

The metamorphoses properly so-called, characterized by the phenomena of histolysis followed by histogenesis, bear, moreover, even among the Holometabolids, only on the middle portion of the intestine, the muscles, and sometimes on the tracheal apparatus itself.

In the Hymenoptera that I have studied (Wasps, Bees) these

phenomena always correspond with the centripetal tracheal growths. Shortly after the hatching of the larva a first growth of tracheal tubes makes its appearance towards the mid-intestine. At this moment, at the base of the epithelial cells of that organ, appear the elements of future substitution. A careful study of sections shows that the substitution-cells communicate with the ultimate and very delicate prolongations of the tracheal tubes. They may therefore be regarded as tracheal cells analogous to those seen along the course or at the extremities of the tracheal tubes.

The elements of substitution are in a state of rest all through the life of the larva; but from the beginning of nymphosis a renewal of activity sets in: they proliferate actively, join one another and constitute the definite digestive epithelium, whilst the larval tissue enters into histolysis and is thrown off. A fresh tracheal growth appears at this moment; the calibre and arrangement of the respiratory apparatus are modified. At the same time fine tracheoles proceed in great number towards the peri-intestinal muscular layer and penetrate it; the same occurs in the other muscles of the thorax and abdomen.

The terminal tracheal cells, or even the cells of the wall of the tracheal trunks, insinuate themselves into the sarcoplasm of the muscular fibres, there multiply actively and form long linear threads; so that the larval fibre is cut up into little columns, broken up and profoundly altered in form. In the muscular histolysis, whether partial or total, the tracheal cells play an important rôle by a mechanical process, and probably also chemical, but without the phenomena of phagocytosis.

Many of the tracheal cells become free in the general cavity and then disappear on the spot; others furnish the tracheoles of the muscles of the imago, these latter turning out the corresponding larval elements (larval muscular fibres and nuclei).

An American observer, Robert S. Breed*, has described analogous processes in the muscles of a Coleopter (*Thymalus*). One is inclined to ask with him if it would not be well, in considering the tracheal elements, thus far too much neglected, to again take up the study of the Diptera, in which it is classic to describe an intense phagocytosis during the metamorphosis.

In the Hymenoptera the metamorphosis which has just been sketched is completed by the histolysis and total disappearance (without phagocytosis) of the primitive Malpighian tubes and the salivary glands. In short, a burst of ectodermic activity realizes the completion of the following organs, momentarily retarded in the larva: teguments, appendages, œsophagus, rectum (formation of fresh Malpighian tubes), nervous system, and sense-organs.

The tracheal growth is itself a manifestation of this ectodermic activity. It is to be remarked that it corresponds with a period during which Bataillon has noted asphyxial respiratory troubles in *Bombyx mori*.—*Comptes Rendus*, tome cxxxviii. p. 300 (1 Feb., 1904).

* R. S. Breed, "The Changes which occur in the Muscles of a Beetle" (Bull. Mus. Comp. Zool. Harvard Coll. vol. xl. no. 7, Oct. 1903).